

(1) Title of the grant: The Nature of Ultraluminous Galaxies: Infrared Space Observatory Analysis and Instrument Team

(2) Type of report: Final Report

(3) Name of the principal investigator: Shobita Satyapal

(4) Period covered by the report: 10/1/2000 - 9/30/2001

(5a) Name and address of recipient's institution during Grant Year 1:
Nomad Research, Inc.
795 Scarborough Court
Arnold, MD 21012-1336

(5b) Name and address of recipient's current institution:
Department of Physics and Astronomy
MSN 3F3
George Mason University
4400 University Drive
Fairfax, VA 22030-4444

(6) Grant number: NAG5-10021

Award Year 1 Final Report for NAG5-10021

Summary of Research

The scientific goal of the proposed research was to investigate the physical conditions in the nuclear regions of infrared luminous galaxies by carrying out detailed infrared spectroscopic observations of a large sample of infrared luminous galaxies. During the past year, these observations have been successfully analyzed and extensive modeling using photoionization and photodissociation codes has been carried out. Two first-author publications and a second-author publication have been submitted to the Astrophysical Journal and results were presented at two invited talks. Four additional journal papers are in preparation and will be submitted during year 2 of the grant.

The secondary project included in this program was the development of a near-infrared cryogenic Fabry-Perot interferometer for use on future large aperture telescopes. System integration and room temperature testing was successfully carried out for this project during year 1. Helped to develop the Fabry-Perot project's website at (<http://inspiration.gsfc.nasa.gov>)

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Summary of Student Research

1. Supervised student Vanessa Harvey with research on the ultraluminous galaxy, Mrk 231. Instructed the student on data reduction, analysis, and interpretation of far-infrared spectra of this galaxy obtained with the Infrared Space Observatory. A publication describing this research will be submitted in the near future.
2. Supervised NASA academy summer intern Erin Royce in the development of a Fabry-Perot interferometer. The student made a presentation on employing a commercially available digital control system to operate a previously assembled mechanism.

Technical Reports and Publications Supported in Part by this Grant

- "Unified Photo-Ionization/Dissociation Models Of Starbursts; A Detailed Study of the Interacting Luminous Infrared Galaxy Arp 299," **Satyapal, S.**, Luhman, M., Fischer, J., Smith, H. A., Spinoglio, L., Stacey, G., & Unger, S. 2001, submitted to *The Astrophysical Journal*.
- "Far-Infrared Spectroscopic Observations of Ultraluminous Infrared Galaxies: What have we learned?" **Satyapal, S.**, Luhman, M., Fischer, J., Smith, H. A., Spinoglio, L., Stacey, G., & Unger, S. 2001, to be submitted to *The Astrophysical Journal*.
- "The [CII] 158 μm line deficit in ultraluminous infrared galaxies revisited," M. L. Luhman, **S. Satyapal**, J. Fischer, M. G. Wolfire, E. Sturm, C. C. Dudley, D. Lutz & R. Genzel, submitted to *The Astrophysical Journal*.
- "The Unusual Far-Infrared Spectrum of the Ultraluminous Active Galaxy Mrk 231," Harvey, V., **Satyapal, S.**, Luhman, M., Fischer, J., Smith, H. A., Spinoglio, L., & Wolfire, M. 2001, to be submitted to *The Astrophysical Journal*.